



# **Carefx Corporation's Response to:**

## **Arkansas Health Information Exchange (HIE) Request for Information**

Prepared By:

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May 7, 2010

Arkansas Coordinator for Health Information Technology  
Ms. Allison Nicholas  
1401 West Capital, Suite 300  
Little Rock, Arkansas 72201

Dear Allison,

On behalf of Carefx Corporation, I would like to thank you for the opportunity to respond to the Arkansas Health Information Exchange (HIE) Request for Information.

Carefx Corporation provides an open,/standards based flexible and scalable technology platform that has been proven to improve the safety, cost effectiveness and the overall quality of healthcare. Carefx is in the business of providing Service Oriented Architecture (SOA) interoperability frameworks for healthcare applications and web based medical record access. It has a multi-national presence and is engaged in major RHIO and HIE initiatives in China, UK, Canada and the US that provide authenticated, secure, fully federated web access to medical records by patients, providers and payers over the internet. The collaborative nature of the framework supports secure messaging, clinical inbox, clinical workflow, analytics, a comprehensive disease based patient health record and federated security/identity assets. The consortium of Carefx, Initiate and IBM provides leadership in the HIE and hospital enterprise integration and interoperability market through its active development of standards both within and outside the healthcare industry.

We accept the response conditions outlined in the original RFI document and have made every possible effort to ensure the accuracy of this response. Thank you, again, for this opportunity - We look forward to working with SHARE further on this project.

Sincerely,

*Oscar Diaz*

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## **Table on Contents**

Table on Contents .....	3
Mandatory Requirements.....	4
Corporate Contact Information .....	4
Account Representative Contact Information.....	4
Corporate Overview.....	4
References .....	5
Summary Description of Solution - Carefx Corporation's HIE Vision.....	6
Cost Estimates.....	7
Implementation .....	9
General Solution Description.....	10
Interoperability.....	10
Technical Architecture and Approach .....	11
Design Principles and Requirements .....	15
Core Requirements.....	15
Master Patient Index (MPI) .....	15
Data Dictionary and Vocabulary Standardization .....	19
Provider Index and Dictionary.....	19
Standards-based .....	20
Security .....	22
Flexible .....	24

# **Mandatory Requirements**

## ***Corporate Contact Information***

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## ***Corporate Overview***

Carefx Corporation, founded in 2002 and headquartered in Scottsdale, Arizona is a privately held organization that delivers interoperability solutions that are focused solely to the Healthcare vertical market.

The company is playing a very active role in many HIE/RHIO initiatives today by providing industry-leading, market-driven technology solutions that simplify access to patient information, improve patient care and enhance patient safety by streamlining access to the data housed in existing systems and provider communities. This philosophy enables healthcare organizations to protect HIT investments while increasing provider satisfaction.

The key tenets of this philosophy involve enhancing clinical workflows, utilizing applications in new, innovative ways while also ensuring that regulatory compliance obligations are met. Carefx views five core elements as critical to our success:

- Develop and deliver products that utilize open standards and avoid designs that offer proprietary, closed solutions.
- Build flexibility into our technologies that will support any organization regardless of its infrastructure, application mix, or how it presents information to caregivers and administrators.
- Utilize only scalable technologies that will address the needs of small, departmental solutions, as well as those of multi-facility, enterprise-wide needs.
- Operate as a true partnering organization and build solutions that ensure success for all interested parties.
- Perform all of the above with a focus on on-time, on-budget delivery and providing a robust return on investment.

Fusionfx, from Carefx, provides healthcare organizations with the ability to leverage health information exchange strategies in a meaningful manner for their clinician, business office and patient populations. Fusionfx provides a context enabled patient information aggregation platform to portals and portlets by synchronizing the entire framework around the users' preferences. With the portal aware of context, we can provide custom viewers into existing applications enabling physicians to consult their clinical application suite from any browser-enabled workstation for real time, anywhere access to critical data points necessary to make treatment protocol decisions. A subset of a patient's data can also be securely delivered through a Patient Portal with context enablement allowing a patient to login and view/update/add clinical information.

Carefx solutions, customers, development protocols, executive presence, and employees are all healthcare-centric. Our products are consistently recognized by our customers for their inherent abilities to enhance the clinical, administrative and financial workflows with which they interact. As a result, virtually every global, cross-industry access management infrastructure vendor has chosen to partner with us in the healthcare market space.

Carefx is providing this response as a consortium that includes Carefx, IBM, and Initiate Systems.

## **References**

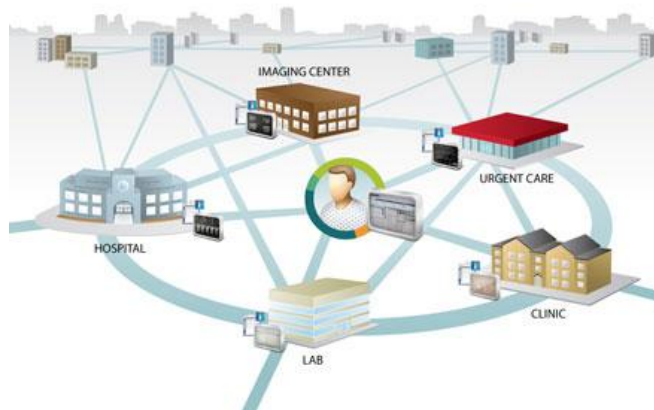
***The Louisiana Rural Health Information Exchange*** selected Carefx, CA, IBM and Initiate Systems to provide an integrated platform to realize their vision of a federated, patient-centric regional eHealth initiative. Contact: Jamie Welch, CIO, Rural Hospital Coalition ([jwelch@larhc.org](mailto:jwelch@larhc.org) - 225.389.9429)

***Trillium Health Centre*** is one of Canada's largest community hospitals, serving over one million residents across Ontario. Using the latest innovations in healthcare technology including Fusionfx from Carefx to optimize care, Trillium has provided their care providers with an integrated means of accessing patient data. Contact: Benoit Long, CIO ([blong@nt.thc.on.ca](mailto:blong@nt.thc.on.ca) - 905.848.7381)

***Catholic Healthcare West (CHW)***, headquartered in San Francisco, CA, the eighth largest hospital system in the nation is a system of 42 hospitals and medical centers in California, Arizona and Nevada. The CHW network of more than 8,500 physicians and approximately 450,000 employees provides health care services to more than four million people annually.

CHW implemented a new Web-based technology solution that gives clinicians secure anytime, anywhere access to a unified view of integrated patient information. Contact: Nicholas Caputo, MD ([nickcap@cox.net](mailto:nickcap@cox.net) - 480.748.9225)

## ***Summary Description of Solution - Carefx Corporation's HIE Vision***



The Fusionfx solution suite from Carefx provides standards-based, service oriented, workflow portals for healthcare. Fusionfx gives caregivers a unified view of relevant patient information by creating composite views of data from multiple sources. A library of nearly 200 portlets, developed using a patent-pending workflow technology, enables the rapid build-out and deployment of provider-centric portals that meet the unique clinical and business process needs of an organization.

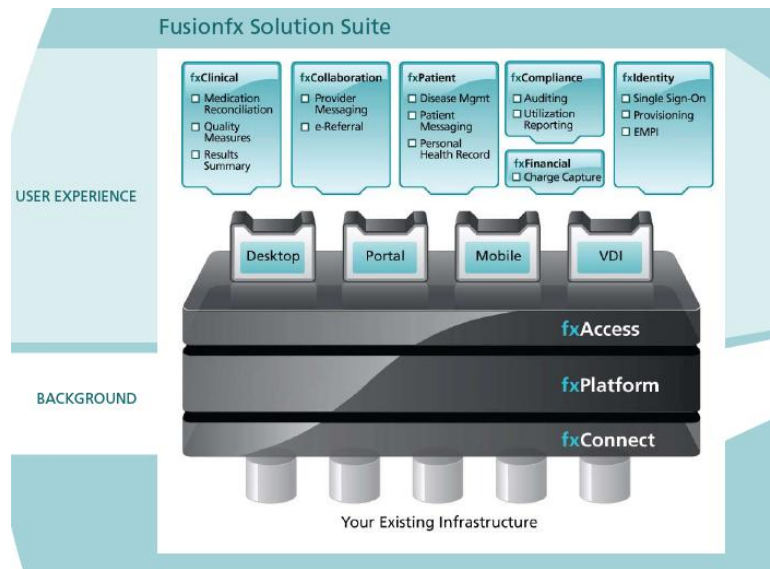
In conjunction with IBM and Initiate Systems, Fusionfx provides an enterprise master patient index that becomes the source of truth for all patient identification. Based on multiple matching criteria and SHARE based thresholds, the system matches patient records or identifies records that require manual intervention. In addition to matching records, the system provides record locator services (RLS) to quick and accurate record searches that only query source systems with pertinent information.

Fusionfx integrates clinical context and single sign-on to provide a seamless end-user experience with automated launching of native applications. The solution streamlines how providers interact with patient data, reducing clinical errors and increasing individual productivity. By closing the gaps that occur between different providers, venues, and systems, care providers can offer a more consistent, higher quality experience for the patient.

Fusionfx combines the latest designs in emerging technology and the resiliency of the world's most pervasive Web platform to bring together the critical stakeholders in today's healthcare environment.

The collaboration framework in Fusionfx aggregates clinical data and delivers it to providers and patients in formats that are clear, consistent, and convenient. Privacy and security are maintained through centrally managed, role-based access. A comprehensive auditing trail ensures compliance. This framework brings care providers and patients together while protecting the patient's data and the user's identity. Clinicians can focus

on the data needed to provide quality care, patients can focus on their health, and organizations can focus on the future.



## Cost Estimates

### Assumptions

1000 total system users

- Up to 250,000 patient lives
- Carefx Fusionfx Physician Portal
- Data from up to eight participating applications (as available) for viewing in the portal could include:
  - Laboratory results
  - Emergency Department reports
  - Inpatient discharge summaries
  - Operative reports
  - Radiology reports
  - Pathology reports
  - Immunizations
  - Notifiable disease incidence
  - Current medications/medication history
  - Allergies
  - Problem lists
  - Previous surgeries
  - Treatment encounter data – encounter date, type, provider, chief complaint
  - Patient identification/patient matching data
  - Vital signs

- Comprehensive student health record capability

This cost proposal does not include hardware. Hardware estimates do not exceed \$80,000. These are estimates only and actual costs may be lower based on further review of requirements. Travel expense are typically less than 5% of project delivery cost.

#### **SOFTWARE APPLICATION PURCHASE COSTS**

Name of Application	One-Time Cost	Annual Maintenance	5-Year Total Cost
Carefx Fusionfx Physician Portal	240,000	48,000	480,000
IBM Access Manager	60,000	12,000	108,000
IBM Websphere Portal Server	242,000	48,400	435,600
Initiate EMPI	234,496	56,279	515,891
Total Software Application Cost	776,496	164,679	1,539,491

Annual Maintenance fees include all new versions, revisions, updates or upgrades to the Carefx Software that Carefx distributes generally to other customers under support and maintenance. Maintenance fees also include 24/7 support as described in the “Maintenance and Support” section of this document.

#### **SERVICES COSTS**

Name of Service	One-Time Cost	Annual Maintenance	5-Year Total Cost
IBM Installation Fees	60,000		60,000
Training (incl. in other line items)			
Initiate Implementation Fees	192,400		192,400
Carefx Integration, Implementation, Training, and Project Management Fees	850,000		850,000
Total Service Cost	1,042,400		1,042,400

#### **HARDWARE PURCHASE COSTS\***

Item	Quantity	Unit Cost	Total One-Time Cost	Annual Maint Fee
Standard Intel Based Windows Server	8	10,000	80,000	10,000
Total System Hardware Costs			80,000	10,000

\*NOTE: Carefx does not sell hardware. These are estimates only.

#### **SUMMARY OF COSTS**

Category	One-Time Cost	Annual Maintenance	5-Year Total Cost
System Hardware	80,000	10,000	96,000
System Software			
Software Applications	776,496	164,679	1,539,491
Services	1,042,400		1,042,400
Total Purchase Cost	1,818,896	164,679	2,581,891



## ***Implementation***

Generally, the timeline to deploy Fusionfx falls within a range of 9 to 12 months. The following project management tasks are performed during a Carefx software implementation.

- Create and maintain detailed project schedule with milestones for Carefx's activities and Health Exchange dependencies..
- Conduct a weekly status meeting with the Health Exchange and Carefx to review progress, upcoming activities, and any issues and/or risks. Deliver a status report to the entire team within one (1) day of this status meeting.
- Maintain a log of all project risks and issues; actively manage resources to resolve these items within committed timeframes.
- Manage any project and/or scope change.
- Staff resources required to deliver the tasks and deliverables described herein.
- Coordinate all training events defined in the Training and Education Section of this document.
- Provide an Executive Sponsor for account level issue escalation and relationship management
- Provide a Project Director to oversee the service engagement, provide an issue escalation path, ensure the project is staffed correctly, and ensure the project is delivered according to standards for process and quality.
- Manage resources performing the tasks and producing the deliverables described herein.
- Coordinate periodic Executive Sponsorship meetings between the Delivery Executive Sponsor and the Health Exchange Executive Sponsor.

# General Solution Description

## *Interoperability*

With the Fusionfx model, data owners will maintain custody of the data that is viewed through the HIE, thereby eliminating the governance issues faced by implementing a CDR. Fusionfx will allow for registration (for users) and the ability to opt out (for patients) such that no personal health information (PHI) is ever viewed inappropriately. Each user, patient, encounter, order/result, image, etc. that is accessed and viewed by interaction with Fusionfx and the HIE is secured, monitored, audited and confidentiality is maintained via rules engines maintained by your HIE. Fusionfx can also utilize information such as provider role, type, etc. to limit access as needed. We build data access layers to the source data systems using the gamut of know calls (API, SOA, SOAP, SQL, etc.)

Fusionfx from Carefx™ provides pre-built inbound and outbound Message-Based Transaction Services (MBTS) that provide persistent, managed queues for message-based interaction with external applications and messaging infrastructures. Fusionfx utilizes inbound message readers that queue messages and acknowledge receipt, brokers that process the queues, and outbound message senders. Fusionfx's message center uses TCP/IP and supports a variety of standards and formats including XML, XSLT, delimited or fixed length messages, or HL7. As with any enterprise class system, Fusionfx's message readers, brokers and senders can be scaled within and across servers independently of the core engine. The expected content and event services for each message type can be configured without writing code or customizing the delivered message brokers. For example, Fusionfx offers an XML DTD that customers can use or can be configured for a customer-provided DTD.

Fusionfx is implemented by communicating with multiple disparate systems and environments via SOA and SOAP (web services) layers that access systems participating in the HIE. Additionally, a robust message processor (Message Based Transaction Service "MTBS") is provided to support XML, XSLT, HL7, and other types of interactions.

Carefx supports a wide variety of industry standards for interoperability. Our solution blends platform independence at every tier with broad integration for surfacing our capabilities. Fusionfx supports WSDL and Web Services inbound and outbound, C++, ODBC and Java for APIs, SSL and TCP/IP for networking, TCP/IP, XML, and both CSV and fixed length flat files for messaging. Fusionfx has proven its interoperability in pure Microsoft environments (Microsoft itself), Java, J2EE, and .NET centric environments.

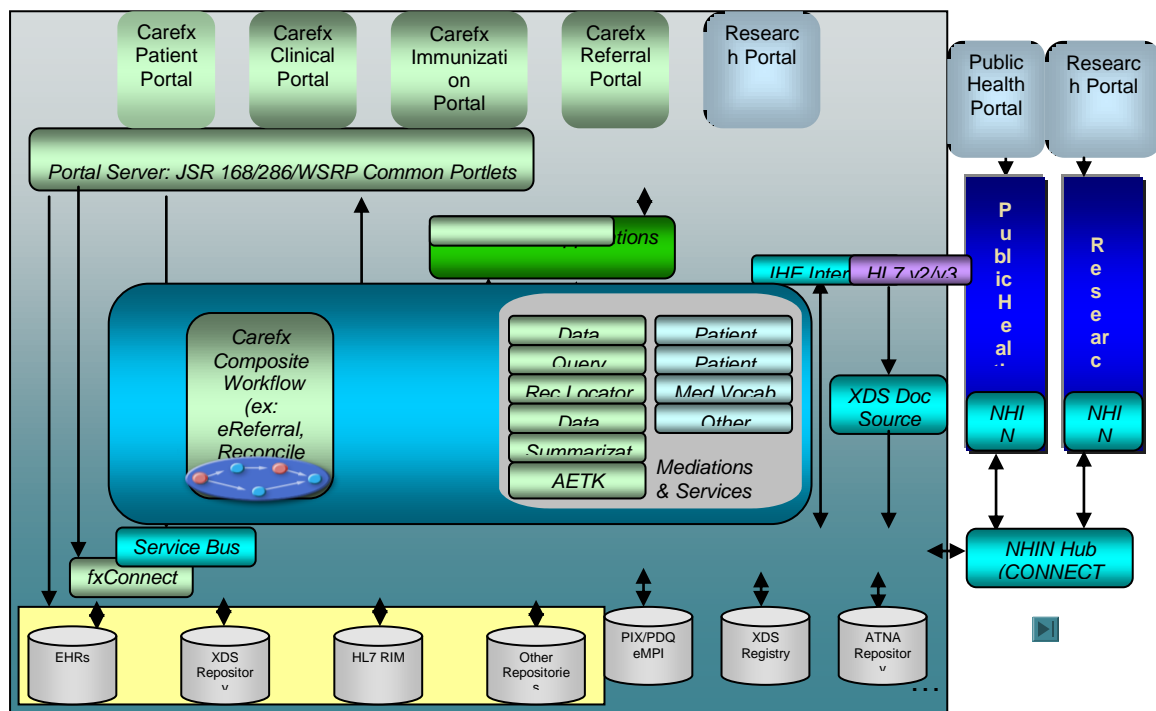
Fusionfx provides a full set of Web Services APIs and can invoke external web services. Web Services enhance Fusionfx's flexibility to integrate customer data across your enterprise. They take advantage of a wide variety of open standards and protocols, such as XML, SOAP and WSDL. New Web Services definitions are continuously added for new features and functions.

HL7 (version 2.x or 3.x) or non-HL7 formatted messages are supported. Interfaces can be accomplished by a variety of data exchange standards, including XML, Web services, EDI (X12 or EDIFACT), flat file (FRL, VRL, HRL), HTTP(S), and FTP are supported as transport protocols.

By providing a flexible and comprehensive integration platform, Fusionfx can accommodate the interface mechanisms available in the specific applications identified as source systems to the HIE.

Carefx has integrated with over 300 healthcare applications including, but not limited to: Siemens, Cerner, McKesson, Meditech, Epic, Eclipsys, NextGen, Allscripts, Misys, Picis, GE/IDX, Fuji, Philips, Stentor, Agfa, Dairyland, CPSI, HMS, Heartlab, T-System, SCC, Logicare, Emageon, 3M, Caredata, QuadraMed, Kodak and Healthvision. We can leverage your existing individual organizations' EMR applications, or develop integrations with a third-party EMR of your choice.

Additionally, the Initiate™ software enables our customers to achieve HIPAA compliance by delivering the tools to maintain medical information and patient data privacy. Initiate Systems has reviewed and continues to monitor the HIPAA Regulations & Standards to ensure our own compliance, as it pertains to our software, with national standards to protect



## Technical Architecture and Approach

The proposed architecture offers the following benefits:

- Offers a secure and robust platform for the development, deployment and management of enterprise integration and composite applications

- Offers an open, Service Oriented Architecture (SOA) that can leverage existing IT services and assets. The composite application development technology enables rapid implementation of new solutions for the enterprise and eases adoption of the solutions
- Solution components have been used in the healthcare industry for decades. It has been successfully deployed nationally and internationally. Initiate Identity Hub component was also used in three out of the four implementations for the NHIN Prototype Architecture

#### Key Features of the Architecture:

- Enterprise Master Patient Identification (EMPI)

The EMPI is a persistent data store that serves as an index of basic data unique for each patient and includes pointers to data sources. The EMPI component provides unique identification of a patient while ensuring that duplicate patient identifiers are merged as necessary. Initiate's Identity Hub is proposed as the EMPI component to create complete, real-time views of data from all applications and data sources to more effectively manage, control, analyze and integrate relevant patient information while protecting data privacy. Initiate uses a statistical approach to locate the proper patient identifier based on demographic characteristics. Identity Hub is designed to uniquely identify subjects during the duration of the transactions within the HIE (i.e. creates unique, fully scoped, entity identifiers to distinguish or reconcile patients with the same name between systems).

- Record Location Service (RLS)

The RLS is a core component of the EMPI engine. It uses directory and registry information from the patient registry or provider registry to search, find, retrieve and aggregate data. The RLS serves as a coordinating service by linking diverse patient records across distributed administrative and clinical data sources to produce a consolidate patient centric data.

- Data Aggregation

The Data Aggregation component provides capability to access patient and provider information across distributed data sources to build a consolidated patient centric view. Carefx delivers a context enabled portal that supports the JSR168/WSRP standards. Carefx has extended the JSR168 APIs to include the HL-7 CMA subjects for context sharing.

- Data Access and Data Exchange Interfaces

Carefx has developed a SOAP/SOA based Data Access Layer that supports connectors for Mumps/Cache, Magic, SQL, ODBC/JDBC and business object meta layers such as Millennium Objects from Cerner, Objects+, etc. The portal can then integrate native healthcare applications within the JSR168/CMA containers, native web applications, and real time database extractions from healthcare applications

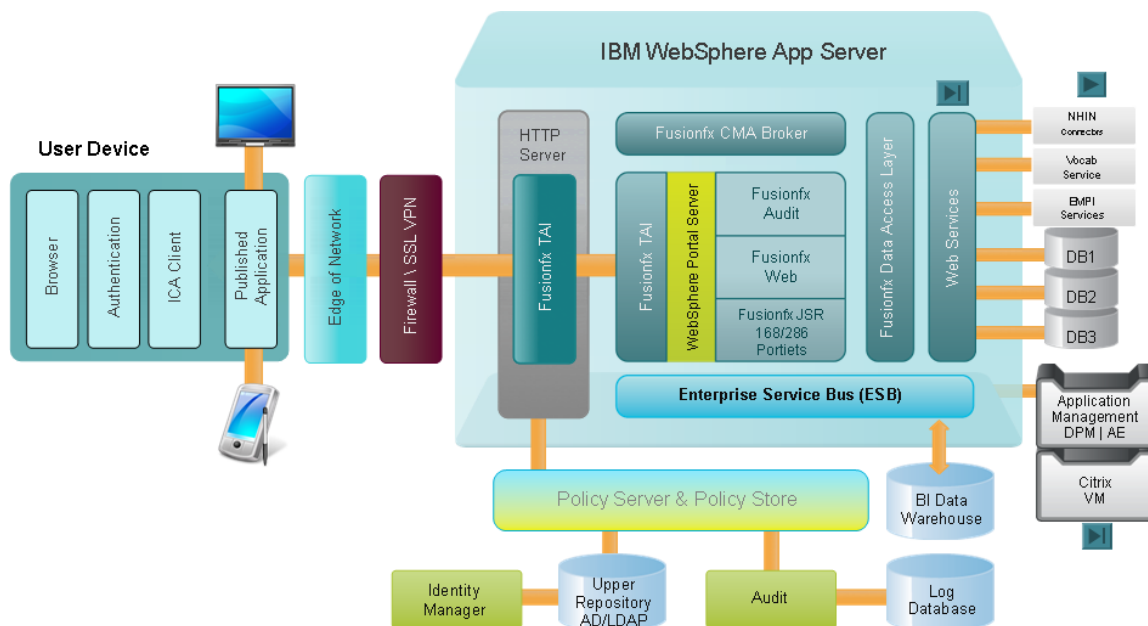
such as Siemens Invision, Eclipsys, GE Centricity Enterprise System (CareCast), Streamline Health's ScanANYware and AccessANYware, Peoplesoft and others.

Additionally, Carefx supports the WebSphere SOA HL-7 Broker that integrates with the Enterprise Service Bus. This infrastructure will facilitate the population of any variety of databases from minimal core data sets as required.

- User and Identity Management

Meeting the requirements of HIPAA must be weighed when implementing an HIE solution. In particular, the determination must be made of what data will be fed into and retained in an EMPI "index" and what clinical providers have access to that data.

Authentication is the act of validating a provided identity (both systems and users). Authorization is the validation of access rights and permissions the entity has to specific resources. Leveraging a core set of Web services standards, the solution can execute security policies bound to user and patient credentials in a true federated model.



Fusionfx from Carefx™ approaches availability from two perspectives. The first is high performance - how fast is the solution for the user, and the second is how can the solution tolerate and recover from failures. In terms of performance, as discussed above in the previous sections, Fusionfx is architected to provide unmatched performance and scale for patient recognition and User concurrency. The following sections will discuss fault-tolerance by tier.

When planning for high availability, it is important to take into account all the tiers involved in patient data management flows. Fusionfx can be deployed on clustered

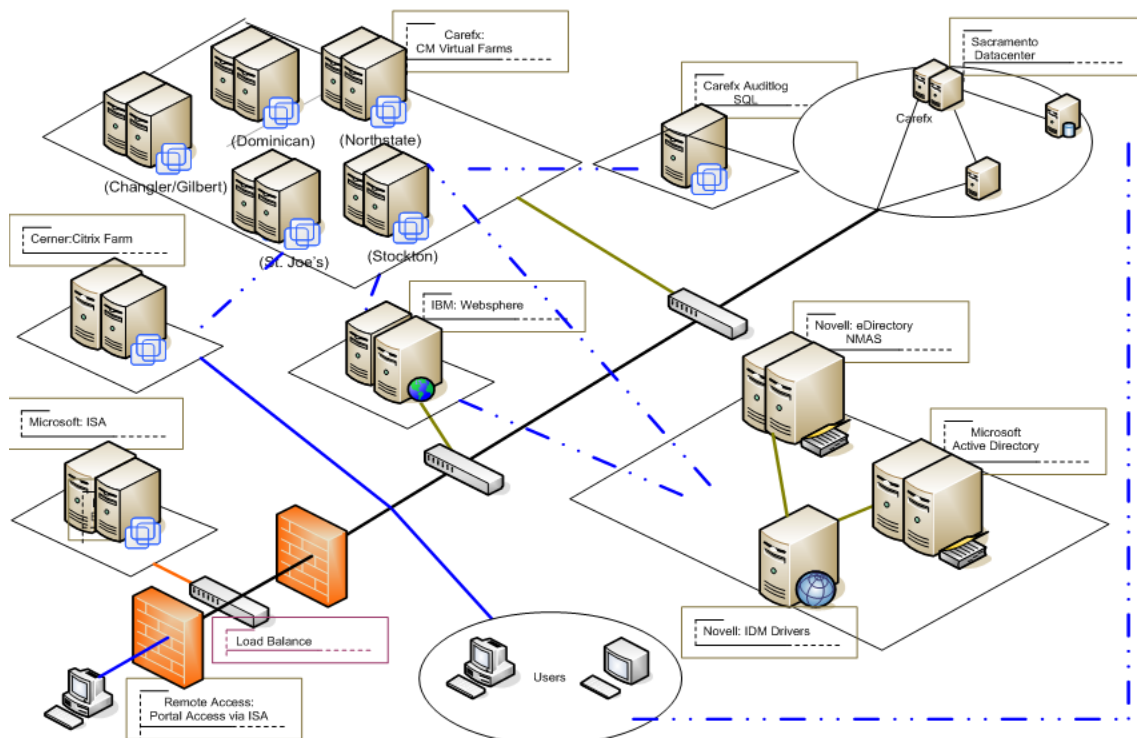
servers and standard high availability techniques can be applied to increase availability. Organizations should also consider the needed levels of availability for the solution. The HIE and Web Services tier can be deployed in clustered, load-balanced environments that adhere to Service-Oriented Architecture (SOA) principles as desired.

In multi-server scenarios, the loss of a Fusionfx server does not result in an outage because the load-balancer routes the traffic to the surviving servers. Similarly, the environment can tolerate the loss of a Web Services application or web server. If the database server for Fusionfx node fails, Fusionfx detects the loss of database connectivity and will attempt to re-establish its database connections. As long as the database can be reached, Fusionfx will be able to process transactions. Depending on the DBMS vendor and how the DBMS cluster is configured, the loss of a database server may result in a brief outage while the database itself is failed over.

### ***Multi-Server***

Fusionfx supports “Multi-server” configurations, with multiple engines running in parallel on two or more physical machines. This type of configuration increases scalability and can help increase availability. Customers can use technology of their choice for load balancing across the available Fusionfx nodes, for example, a software-based solution such as hardware solutions such as those offered by Cisco or F5 Networks. Large scale multi data center implementations are supported in the architecture. This provides high availability and five 9s reliability with full online disaster recovery. The user sees no interruption in service.

The users’ interactions with the HIE invoke the Fusionfx software APIs, for example, the Web Services, and the APIs reference a virtual hostname. The resultant TCP/IP traffic can be load-balanced using a hardware load balancing technology as desired. Any available engine can process a request – there is no requirement for “server affinity” for a given calling application.



## ***Design Principles and Requirements***

The Carefx Fusionfx solution suite is designed to accommodate the leading best practices for integrating healthcare information and as such follows the work that has been produced by the extensive discussions of the Connecting for Health Steering Group, and integrates the foundation work of the Connecting for Health Common Framework (2006) and the Roadmap on Achieving Electronic Connectivity (2004). As envisioned by the Markle Foundation, these principles are the basis for a healthcare information environment that enables high-quality decision-making and creates an intelligent, safe foundation for integrating healthcare data for the 21st century.

Specifically, Carefx's Fusionfx supports the following First Principles of the Connecting for Health framework:

- Designed for Decisions – to provide the decision-making capabilities of all involved in the treatment cycle.
- Designed for many – to anticipate and incorporate different perspectives and deliver data that meets the needs of different users
- Shaped by Public Policy Goals and Values – most commonly stated as improving public health, creating more positive outcomes, reducing threats to public health, respecting confidentiality, and increasing scientific knowledge.
- Boldly Led, Broadly Implemented – by using the world's most popular technologies and allowing for broad participation in the design, development, and deployment of the solution.
- Possible, Responsive, and Effective – by offering realistic deployment models and proven efficiencies that positively affect the public and policy goals outlined earlier.
- Distributed, but Queriable – by distributing the intelligence of the process engine so that intelligent points of leverage can be achieved, but auditing and monitoring those rules to create the appropriate transparency in the network.
- Trusted Through Safeguards – by offering a combination of safeguards that respect privacy and confidentiality while protecting data and preventing errors.
- Layers of Protection – by providing a layered perimeter of security to protect data appropriate to the risk and not moving data to centralized repositories where governance, latency, and liability issues could occur.
- Accountability and Good Enforcement – through system-level auditing of access, identities, patient data, network-centric processes, and policy enforcement while allowing mechanisms for redress if the protocols are broken.

## **Core Requirements**

### **Master Patient Index (MPI)**

The MPI is a persistent data store that serves as an index of basic data unique for each patient and includes pointers to data sources. The MPI component provides unique identification of a patient while ensuring that duplicate patient identifiers are merged as necessary. Initiate's Identity Hub is proposed as the MPI component to create complete, real-time views of data from all applications and data sources to more effectively

manage, control, analyze and integrate relevant patient information while protecting data privacy. Initiate uses a statistical approach to locate the proper patient identifier based on demographic characteristics. Identity Hub is designed to uniquely identify subjects during the duration of the transactions within the HIE (i.e. creates unique, fully scoped, entity identifiers to distinguish or reconcile patients with the same name between systems).

The proposed MPI solution uses Initiate Systems' probabilistic algorithm to compare records. Technology to enable probabilistic matching is imperative if computers are to replicate, consistently and effectively, the evaluation and judgment processes of human clerks attempting to link common records. Ideally, computers would emulate the intuitive thought processes of human beings as they review, judge, evaluate, measure, and score linkage qualifications of records representing commonality. Neither the technique of shared identifiers nor the deterministic matching method is able to match records under conditions of uncertainty. Only probabilistic matching mimics the human ability to recognize that two slightly dissimilar records are in fact the same object.

**Probabilistic Algorithm:** The theory of probabilistic matching, pioneered by statistical decision theorists, Fellegi and Sunter, in the 1950s recognizes that each field-by-field comparison is subject to error. This approach considers both the probability of a mismatch between data values in two records that represent the same entity and the probability of a coincidental match between two records representing distinct entities. When one calculates the likelihood ratio that the records refer to the same entity as compared to the hypothesis that they refer to different entities - while allowing for incomplete values and/or error conditions within the records - the process is said to be probabilistic.

**The Importance of Probabilistic Algorithms:** The problem of record matching can be addressed by one of three standard approaches: matching through shared identifiers, deterministic matching (sometimes called exact match logic), or probabilistic matching. Matching through shared identifiers only works when there is a reliable identifier (such as an MRN number) that is completely and consistently populated in all data sources and is absolutely free from recording error. When such an identifier is not available, as is often the case, one of the other two techniques is required.

**Deterministic matching** examines a subset of attributes and marks two records as referring to the same member if they agree on this subset. A simple example would be to link two records if they agreed on last name, first name, and phone number (many real-world examples have complicated rules which deal with missing attribute values and other anomalies). The two main drawbacks to this approach are that it often misses matches because of variations in data values (e.g. "ROBERT" versus "BOB") and that this technique does not scale well to large datasets because it does not take into account attribute frequency; that is, a match on the last name "SMITH" does not mean as much as a match on the last name "EINSTEIN."

**Probabilistic matching** avoids the drawbacks of the other two approaches by recognizing the variability in attribute values and incorporating that knowledge into the decision whether to match or not. Among all the approaches to record matching, probabilistic matching allows the greatest flexibility and provides the highest accuracy. Neither the



technique of shared identifiers nor the deterministic matching method is able to match records under conditions of high variation in the data. Only probabilistic matching mimics the human ability to recognize that two slightly dissimilar records are in fact the same object.

Enhanced Soundex and NYSIIS phonetic encoding is used to ensure that thorough searches are completed on all names. Look-up tables are used to equate formal and informal names (e.g. James and Jim will receive the same phonetic encoding).

Initiate Patient™ software's scoring algorithm addresses facility or source system-specific variations in population names and demographics. The weight table is derived from source system specific data. A typical example deals with a last name of Hernandez. Hernandez in California would receive a lower score than Hernandez in Wisconsin if name attribute value "Hernandez" occurred less frequently in the Wisconsin data source than in the California data source. Initiate Systems always builds the weight table and threshold settings based on the customer's own data taking advantage of the uniqueness and nuances of the actual data.

Initiate Patient™ software can be configured to take advantage of different weight tables depending upon the sources being compared. This is an important feature in an enterprise spread across large geographical areas.

Initiate Systems provides its own Record Locator Service. Please see the following for details of that product.

Initiate Patient™ Software as a Record Locator Service Initiate Systems is well suited to serve as a record locator service in a federated HIE architecture. This allows organizations at a local level to maintain, secure, and release their patient-specific clinical data, thus advancing trust, confidentiality, and security while enabling participation in regional data exchange initiatives.

The first key step to achieving HIE integration is establishing a person identification and matching solution – the process must find the right person with accuracy and efficiency. This would require HIE participants to provide a limited subset of demographic data – like name, birth date, phone number, address, and SSN – to the Initiate Patient™ software. This would provide search and linking capability, as well as data stewardship and governance capabilities, as required; for participant sources.

The Initiate Patient software can receive this demographic data via any number of integration tools; HL7 messages, XML, various API integration and other data standards are supported. The HIE portal (the selected tool which will provide access and conglomeration of clinical data) can then utilize the software's functionality to first identify the right person, collect all relevant source system identifiers for that person, and then retrieve clinical data from participating sources.

The process of how this might be achieved is outlined in the following steps:

1. Demographic data from participating systems is provided to the Initiate Patient software as the NMPI of the Integrated Health Network. Participants can provide

- a baseline of existing patients via an extract. Or, they can provide demographic transactions as patients are seen to establish participation. The HIE can determine its preference. Software from Initiate Systems has a highly flexible data model. Providers could provide different data sets, as well as different timing (i.e. real-time, nightly, weekly or monthly batches), if needed.
2. Data presentation and threshold settings are configurable based upon the business practices of the HIE. Specifically, the HIE can define what patient identification data elements would be presented to an authorized query, and the role based security that the Initiate Patient software supports would allow for differing views. Additionally, the HIE can define, with Initiate Systems' assistance, the specific thresholds for defining when a patient query represents a match or potential match. The Initiate Systems query API supports a variable threshold which allows the HIE to tailor match responses to particular situations.
  3. The HIE portal, which is chosen by the HIE and is not a technology from Initiate Systems, would allow the provider access to whatever clinical data has been established as key by the HIE. This data could be centralized, federated or a hybrid model can be utilized. The HIE portal could request the data directly from the providers, or utilize data federation capability offered in the Initiate Patient software.
  4. The HIE portal provides the access and presentation information, but it utilizes the Initiate Master Data Service™ platform's probabilistic search and retrieval capabilities to ensure the accurate identification of the patient. It can also utilize the access controls which may be needed to ensure HIPAA compliance efforts and other HIE audit controls that are enabled. Search criteria can be established by the HIE, or in conjunction with Initiate Systems, to meet a particular organizational goals.
  5. For some of Initiate Systems' health information exchange customers, establishing and maintaining data quality has become a major consideration. The data from participating systems can be provided to Initiate Systems, and analytics can be performed to determine data content and quality. Business standards would be set by the HIE as part of participation and implementation strategies. Initiate Systems has proven experience and has performing more than 1,000 analyses and 600 remediation projects. We have worked with more than 600 healthcare organizations, including some of the largest and most organizations in the United States and Canada. With more than 1,000 files analyzed representing over 1 billion records, Initiate Systems has extensive experience with establishing and maintaining high data quality.

The software is designed to be highly performing and scalable. As participants are established, the software can be expanded to meet growing requirements. A wide variety of customers have utilized our software to support large volumes of data as well as large volumes of transactions.

Additionally, the Initiate Master Data Service platform is highly configurable. The HIE may have need for multiple integration strategies to meet varied requirements from participants. Its needs may also change over time, as participants are added or fall out, and the Initiate Systems products will ensure ample options for implementation.

Initiate Systems will utilize the customers LDAP or AD services for identity management.

Initiate Systems provides an application called Workbench. This tool is the administration module for defining attributes that will be utilized by the Record Locator Services.

## **Data Dictionary and Vocabulary Standardization**

Fusionfx will support two levels of vocabulary translation: Terminology Normalization and Vocabulary Services.

With Terminology Normalization, a set of translation tables are maintained within the portal. Customers may define or import a set of standardized terms, and cross map them to terms that are local to each source system. Users will be able to query for data, place orders, etc, using the standardized terms without having to learn naming conventions that are peculiar to each system. Retrieved data may be displayed with local, normalized, or both nomenclatures.

Carefx is also working with external partners (Apelon, IBM, Arizona State University) to implement a rich set of Vocabulary Services. In addition to terminology normalization and cross mapping, Vocabulary Services offer the user the ability to find information using published, reference terminologies, synonyms and equivalent phrases, as well as clinical categories. For example, a search for analgesics would find aspirin, ASA, and acetaminophen orders for a patient. Among the reference terminologies supported are: Snomed, LOINC, RxNorm, NCPDP, CPT, ICD codes. Other coding systems could be added as well.

## **Provider Index and Dictionary**

Accurate and complete provider data is a key component of an interoperable health strategy. This strategy requires a single view of the provider community and the relationships those providers have with patients, including referrals, affiliations with clinics and laboratories and other practitioners.

Initiate® Provider Management leverages proven technology and experience to associate provider information across multiple source systems to create a single source of truth for provider data. Access to accurate provider data across the ecosystem lowers operational costs, reduces compliance risk and makes health systems preferred business partners.

Initiate Provider is built upon the Initiate Master Data Service® platform and includes Initiate Inspector™, an innovative web based collaborative data stewardship tool to assist your team in identifying and resolving data quality issues. The product offering is pre-configured to load, manage, integrate and exchange provider data with downstream clinical information systems and reference third party sources to validate provider identification and credentialing information. Many customers realize significant value in pairing Initiate Provider with Initiate® Patient to gain insight into patient-provider relationships, enabling improved coordination of care.

Initiate Provider eliminates the need for custom development of system and user interfaces. Designed for rapid integration, Initiate Provider offers options to facilitate out-of-the-box communication with downstream systems and external reference data sets.

The pre-defined provider data model includes characteristics common to care providers in real-world implementations and is flexible enough to manage all types of care providers, including physicians, nurses, laboratory technicians and home health providers. The algorithms are optimized for standardization, comparison and weightings of provider population for both providers as practitioners and provider organizations. In addition, Initiate Inspector™ is ready-configured to support identification, prioritization and resolution of provider-related data quality issues. Collaboration and reporting tools help data stewardship teams work together across organizational boundaries. Simple tools are available for viewing and managing relationships between providers and their practice locations.

Initiate Provider integration toolkit is comprised of application brokers and pre-defined data load templates designed for provider data. The Carefx portal utilizes callable events for the most common provider integration transactions, including add, update and merge.

## **Standards-based**

Carefx and Initiate strive to build solutions that are standards base that allow future growth and interoperability. Below is a list of standards organizations that Carefx and Initiate are actively involved with and/or support:

- IHE
  - PIX - HL7 V2
  - PIX - HL7 V3
  - PDQ - HL7 V2
  - PDQ - HL7 V3
- HL7
  - PIX and PDQ V 3
  - CMA
  - V 2/V3
- OMG
  - EIS
- ISO Standards and Information

- ISO/TR 20514:2005
  - ISO 20302:2006
  - ISO/TS 18308:2004
  - ISO 18232:2006
  - ISO/TS 17120:2004
- Industry Standards
  - Liberty Alliance SAML
  - JSR 168/286
  - WSRP
  - SOA : BPEL and standards based ESB
- Canadian Health Infoway
  - E-Health Collaboratory Standards
  - Canadian Health Infoway Blue Print
- CCHIT
  - As CCHIT has not finalized the HIE certification standards, we closely monitor the workgroup's activity and attend public hearing/forums to provide input to CCHIT. With the ongoing discussion primarily focused on privacy, security, and data sharing, we believe Fusionfx will meet the draft and final standards from CCHIT on HIE.
- Public Health Information Network (PHIN)
  - Initiate Systems has participated in IHE demonstrations focusing on PHIN requirements.
- National Institute of Standards and Technology (NIST)
  - Initiate Systems actively participates with NIST via IHE and HIMSS sponsored events.
- International Organization for Standardization (ISO)
  - Initiate Systems actively monitors the CCR initiatives within ISO.
- American Society for Testing Materials (ASTM)
  - Initiate Systems monitors and incorporates ASTM requirements into our solution.
- Federal Public Key Information Policy Authority (FIPS)
- Healthcare Information and Management Systems Society (HIMSS)
  - Carefx, IBM and Initiate Systems actively participate in world wide HIMSS Events.
- Liberty Alliance
  - The consortium actively meets with Liberty Alliance and continues to monitor and participate in those events.
- American National Standards Institute (ANSI)
  - The consortium actively incorporates ANSI standards into all of our products.
- The Open Group (TOG)
  - The consortium actively contributes and uses TOG based standards and products.

- Object Management Group (OMG)
  - The consortium is an active member of OMG and a contributor to the HSSP initiatives.

In addition, Carefx provides support for CCD/CDA Architecture. The Continuity of Care Document (CCD) is the result of collaboration between ASTM's Continuity of Care Record (CCR) and HL7's Clinical Documentation Architecture (CDA). CDA provides a framework for exchange/interoperability using "eDocuments". These documents are XML-based and utilize the HL7 RIM (V3) and standardized clinical vocabulary (SNOMED, ICD9). There are both human readable and computable sections of the documents allowing for simple integration between providers with vastly different IT capabilities—at correspondingly more or less granular levels. CDA has several attributes and supports CCR encoding and CDA routing services for three types of messages: Encoded Documents, PDF views of clinical information.

Carefx fully supports the NHIN architecture via our XDS implementation. We are exchanging data via XDS in community health exchanges. The Carefx platform also conforms to the national standards including IHE and HITSP. The platform and solutions use IHE standard transactions and profiles such as XDS, XDS-Image, XDS-Medical Summary, and infrastructure profiles.

## Security

Carefx implements a federated model with clinical data remaining in the originating source systems (or edge servers). In this model, the source system maintains the security policy for clinical data. Carefx adheres to the policies in place in the source systems and does not circumvent the access policies. The access, authorization and auditing of the source system is maintained.

In addition, access to data and functionality within the Carefx portal is controlled using groups and permissions. Permissions can be granted to users or preferably to groups, where a user belongs to one or more groups and the user's set of permissions is derived from all groups the user belongs to. The combination of permissions and groups allows customers to control access in a way that reflects their organizational structures and the roles of users within those structures. Access control is enforced regardless of the method used to interact with Fusionfx – synchronous API or web service interactions from other applications, or message-based interaction.

Carefx can manage authentication directly or can integrate with a Lightweight Directory Access Protocol (LDAP) directory for authentication and role management for access control. When an external LDAP directory is used, only the user's login ID is stored in Fusionfx. The password and group information is stored on the LDAP Server. Access permissions for the user are derived from the groups stored in the LDAP server. With LDAP, Fusionfx authenticates users in the following manner:

- The user is authenticated against the LDAP server. If the user authenticates successfully to the LDAP directory, the user is added to the Initiate Identity

- Hub™ software's local user table without a password. This is done for auditing purposes so that a user's actions can be recorded.
- During LDAP authentication, the user's groups are loaded from the LDAP server and used to determine the privileges of that user. These groups are not propagated to Fusionfx's internal tables. Only the user identifier is stored.

Initiate Systems provides another layer of security by controlling access to patient data. System-wide security functionality enables more discrete control over user access at the source, user group, user, function and attributes level, which is required for Health Insurance Portability and Accountability Act (HIPAA) compliance. Administrators have the ability to deactivate a user record, easily create new user records and control security within the Initiate Patient™ software reporting function. Initiate Systems provides integration through complete bi-directional support with industry-standard LDAP v3 compliant directories, enabling the Initiate™ solution to better adhere to the security policies and procedures of any enterprise. Logging functionality will provide audit records based upon touches, not changes, to any member data within the Initiate Patient™ database.

### **Audit**

Carefx's audit capabilities capture all information being viewed and push the data to a separate database for the purpose of maintaining an audit trail for HIPAA, JCAHO and Security office compliance. Each viewing event is captured. The user is captured at login, the patient is captured at selection from an application's Census data, the Encounter is captured during its selection and the observation is captured during its selection. Each of these events is pushed immediately to the Fusionfx Audit database. The result is one complete, centralized and comprehensive view of each application's use as it relates to user, patient, encounter, and observation information. Custom reporting can run against this data to capture information about specific information e.g. High Profile Patients, HIV positive patients, Inactive User Accounts, Employee Health Record viewing, etc. Authorized users can view pertinent user and patient history from a central location without having to consult each individual application.

Fusionfx Audit offers the following auditing capabilities:

- Tracking and reporting on clinical and non-clinical systems
- Capturing interactions with a patient's electronic record
- Application launch and termination
- User logs on and log off
- Patient selection
- Workstation location

Initiate Systems tracks the source for all member's records and maintains a detailed audit trail for every version of every attribute within every record. So, a given set of record or attribute level additions and changes can be tracked and reversed as needed, including both logical and physical deletion options.

The Carefx solution allows patients the ability to opt in/out such that no personal health information (PHI) is inappropriately viewed within the HIE. For scenarios in which

emergency access is required, Carefx supports a “break the glass” functionality that requires clinical acknowledgement of access and a full audit trail.

## **Flexible**

Carefx delivers industry-leading, market-driven technology solutions that are focused on simplifying access to patient information. Our products are designed to improve patient care and enhance patient safety by streamlining access to the data housed in existing systems. This philosophy also enables healthcare facilities to protect their HIT investments and increase physician satisfaction.

The key tenets of this philosophy involve enhancing our customers’ clinical workflows, sharing data across multiple organizations, participating in regional, state or national HIEs, utilizing applications in new, innovative ways, and helping executive management meet their regulatory compliance obligations. We view five core elements as critical to our success:

1. Develop and deliver products that utilize open standards and avoid designs that offer proprietary, closed solutions.
2. Build flexibility into our technologies that will support any organization regardless of its infrastructure, application mix, or how it presents information to caregivers and administrators.
3. Utilize only scalable technologies that will address the needs of small, departmental solutions, as well as those of multi-facility, enterprise-wide needs.
4. Operate as a true partnering organization and build solutions that ensure success for all interested parties.
5. Perform all of the above with a focus on on-time, on-budget delivery and providing a robust return on investment.